

REMARKS

Claims 4-5, 13, and 21 have been canceled.

Claims 1, 14-16, and 19 have been amended.

New claims 59-61 are presented herein for examination.

No new matter is presented by these amendments.

Examiner Interview

The Examiner is thanked for the telephonic interview of July 21, 2009, during which the subject matter of the claims was discussed. However, no agreement was reached during the interview. Notwithstanding Applicants' belief that the claims as previously presented were patentable over the cited prior art, Applicants nonetheless herein present clarifying amendments to the claims for consideration in an effort to expedite the prosecution and allowance of the present application.

Rejections Under 35 U.S.C. § 112

Applicants respectfully request reconsideration of the rejection of claims 1 and 4-13 under 35 U.S.C. § 112 as being indefinite. Applicants submit that one skilled in the art with reference to the Applicants' specification would understand the claimed gaze projection of a location of the head through outer edges of a virtual window. More specifically, the claimed gaze projection through outer edges of a virtual window would be understood as the volume defined by a virtual window and a set of divergent lines which originate at the location of the head and intersect the edges of the virtual window, excluding that portion which is between the location of the head and the virtual window. In the context of the claimed invention, the gaze projection defines a view-frustum with reference to the virtual window and the location of the head, which would be understood by those skilled in the art.

Rejections Under 35 U.S.C. § 103

Applicants respectfully request reconsideration of the rejections of claims 1, 4-19, 21, and 46-57 under 35 USC § 103(a), as being unpatentable over *Kang* (US 6,009,210) in view of *Kanade et al.* (US 6,151,009). As noted above, claims 4-5, 13, and 21 have been canceled. The remainder of the claims are believed to be patentable over the cited prior art for the reasons set forth below.

It is noted that during the telephonic interview of July 21, 2009, the Examiner indicated that Applicant's recitation of a position of a user's head was interpreted to include both location (e.g. a point defined by x, y, z coordinates in space) and orientation (e.g. rotational orientation) of the user's head. Therefore, Applicants' have amended independent claim 1 to define a view of a scene comprising "a view-frustum initially defined by a gaze projection of a location of the head through outer edges of the virtual window when the location of the head is substantially normal to about a center point of the virtual window." As such, it is noted that the claimed view-frustum is now defined with reference to a location, rather than a position as previously recited.

Accordingly, Applicants' claim 1 also recites that the view-frustum is adjusted "in accordance with the change in location of the head of the user" such that "the adjusted view-frustum [is] defined by an updated gaze projection of the changed location of the head through the outer edges of the virtual window."

I. The *Kang* reference fails to teach adjustment of a view-frustum by updating a gaze projection through outer edges of a virtual window.

A. *Kang* teaches a view defined only with reference to a singular viewpoint.

The *Kang* reference teaches a hands-free navigation system for tracking a head and responsively adjusting the display of a virtual reality environment. *Kang* discloses the tracking of translational and rotational movements of a user's head/face. However, in regard to "the problem of using [the tracked movements] to control the viewing of the virtual reality environment" (Col. 8, lines 26-27), *Kang* discloses only two methods. The first method taught is "to directly use the pose parameters to determine the absolute

position and orientation of the viewpoint” (Col. 8, lines 27-29). In other words, a viewpoint set within the virtual reality environment is moved in the same manner as is detected in the user’s face. Thus, movement of the user’s head to the left causes movement of the viewpoint to the left; rotation of the user’s head in a clockwise direction causes rotation of the viewpoint in a clockwise direction, etc.

The second method taught applies the same directional system, but incorporates incremental control to “indicate continuous movement within the virtual reality environment” (Col. 8, lines 32-40). In other words, positional or rotational movement of the user’s head in a given direction causes continuous movement of the viewpoint in the virtual reality environment in the same manner until the user’s head returns to its initial position and orientation.

However, in either of the viewing control mechanisms disclosed by *Kang*, the actual *view* of the virtual reality environment (the volumetric region which determines what the user would see on-screen, as opposed to the *viewpoint* within the virtual reality environment) moves in the same direction as the movement of the user’s head. As the user’s head moves to their right, so the view also moves to the user’s right; and as the user’s head rotates (clockwise) to the right, so the view pans (clockwise) to the user’s right. This is because the changes in the view are only defined with reference to the singular viewpoint within the virtual reality environment.

B. Applicants’ claimed invention defines a view with reference to both the location of the head of the user and a virtual window.

In contrast to *Kang*, Applicants’ claim 1 defines a view of a scene with reference to *both the location of the head of the user and a virtual window*. The volumetric virtual space beyond the virtual window which is delimited by the gaze projection through the outer edges defines a view-frustum, which determines the user’s view of the scene. As the user’s head moves, the view-frustum is adjusted accordingly, such that the gaze projection through the virtual window is updated in light of the changed location of the user’s head to determine the new view-frustum.

According to Applicants' claimed invention, and in contrast to the *Kang* reference, movement of the user's head in a given direction will produce movement of the view of the scene *in the opposite direction*. In other words, a movement of the user's head to the left will cause the view of the scene as it appears to the user to move to the right. This occurs because the view of the scene is defined with reference to a virtual window which is not disclosed by *Kang*. The effect is somewhat analogous to the movement of a lever about a fulcrum. As one side of the lever moves in a given direction, so the other side of the lever moves in the opposite direction.

II. The *Kanade* reference does not cure the deficiencies of the *Kang* reference.

The *Kanade* reference teaches a method for merging real and synthetic images in real time. The Examiner cites this reference as teaching the use of a depth capturing camera. However, *Kanade* does not teach the view-frustum defined by a gaze projection through outer edges of a virtual window, or its adjustment in accordance with a change in position of a user's head as claimed. Therefore, *Kanade* does not cure the deficiencies of *Kang* as discussed above.

III. Several of the Examiner's arguments require clarification.

A. The Examiner's interpretation of Applicants' claimed adjustment of a view frustum requires clarification.

At paragraph 7(d) of the Office Action, the Examiner states the Applicants' claimed view frustum is interpreted as the "view of the user into the virtual world," which is being adjusted in accordance with the change in position of the head of the user. And at paragraph 16, the examiner states that Applicants' recitation of an adjusted view frustum defined by an updated gaze projection is interpreted as "as the user moves his/her head, the view frustum is changed to reflect said change." In other words, the Examiner appears to interpret Applicants' claimed adjustment of the view frustum as simply adjusting a view of a user into a virtual world, either "in accordance with" the change in position of the head of the user, or "to reflect" said change in position.

However, such an interpretation ignores relevant portions of Applicants' claimed subject matter. Specifically, the adjusted view frustum is defined by an updated gaze

projection of the changed location of the head through the outer edges of the virtual window, this being in response to a move of the head away from normal relative to the center point of the virtual window. The prior art references do not teach a view frustum defined with reference to a location of a user's head and a virtual window, much less its adjustment as defined wherein the location of the user's head moves in relation to the virtual window.

Furthermore, Applicants have amended claim 1 to clarify that the view frustum moves in a direction opposite to the move in the location of the head. Thus, Applicants do not merely claim adjustment of a view "in accordance with" or "to reflect" a change in position of a user's head, but rather adjustment of a view frustum based on updating a gaze projection through a virtual window, such that movements of the head away from normal cause movement of the view frustum in the opposite direction. If the rejections are maintained, then the Examiner is respectfully requested to specifically explain how the prior art teaches Applicants' claimed view frustum and its adjustment as defined in the claimed subject matter.

B. The Examiner's statements regarding a depth camera are traversed.

At paragraph 15 of the Office Action, it is stated that the claimed view frustum is the known view projection associated with depth cameras. Applicants respectfully traverse this statement, and request that relevant prior art be cited if the Examiner chooses to maintain this position. Moreover, Applicants are unclear as to how a depth camera's operation relates to a view frustum defined with reference to a user's head location and a virtual window.

C. The Examiner's statements regarding a rotational angle and left and right require clarification.

The Examiner's arguments at paragraph 16 of the Office Action regarding the rotational angle appear to be misplaced, as Applicants' claimed invention is directed to changes in location, not changes in orientation of the user's head. This should not be read as limiting the claimed invention in any way, as Applicants' are entitled to the full scope of claim coverage afforded by the subject matter defined in Applicants' claims.

Rather, Applicants merely point out that the Examiner's discussion of the rotational angle appears to be unrelated to the claimed invention.

Furthermore, the Examiner's characterization of various entities as having particular orientations and therefore certain left and right sides is arbitrary and subjective. The terms "left" and "right" make sense when used to describe direction in relation to a user who faces a particular direction (as used above), but are confusing as applied to other entities, such as the view frustum. Moreover, Applicants' claimed subject matter is not defined in terms of left and right, but in terms of direction. Thus, the Examiner is respectfully requested to clarify how the prior art teaches Applicants' claimed subject matter relating to directionality.

IV. Independent claims 14, 46, 59 (new), and the dependent claims are patentable for at least the same reasons as independent claim 1.

As discussed, the cited art of record does not disclose the view-frustum and adjustment features as claimed. Therefore, for at least the reasons discussed above, it is submitted that claim 1 is patentable over the teachings of *Kang* and *Kanade*.

Independent claims 14, 46, and new claim 59 include subject matter similar to claim 1. Therefore, these claims are believed to be patentable over the cited prior art for at least the reasons discussed above with respect to independent claim 1. Likewise, dependent claims 6-12, 15-19, 47-50, and 60 are patentable for at least the same reasons as their corresponding independent claims.

V. New claim 61 is patentable over the prior art of record for similar reasons as those previously discussed.

Claim 61 is newly presented and defines a virtual viewpoint separate from the location of the user's head. The user's view of the scene comprises a view-frustum defined by a gaze projection of the virtual viewpoint through outer edges of a virtual window. As the user's head moves away from normal relative to a center point of the virtual window, so the virtual viewpoint moves in the same direction, thereby causing

lateral adjustment of the view frustum in a direction opposite to the lateral adjustment of the virtual viewpoint. Support for new claim 61 may be found in Applicants' as-filed specification at, by way of example, paragraph [0043].


As noted above, the prior art of record does not disclose a view frustum defined with reference to a gaze projection through a virtual window. Nor does the prior art teach adjustment of a view frustum such that lateral movement of a virtual viewpoint causes lateral movement of the view frustum in the opposite direction. For at least these reasons, claim 61 is patentable over the teachings of the prior art.

Conclusion

In view of the foregoing, Applicants respectfully submit that all of the pending claims are in condition for allowance. A notice of allowance is respectfully requested.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 774-6903. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. SONYP029).

Respectfully submitted,
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